

Rule-Based Multidisciplinary Tool for Unsteady Reacting Real-Fluid Flows, Phase II

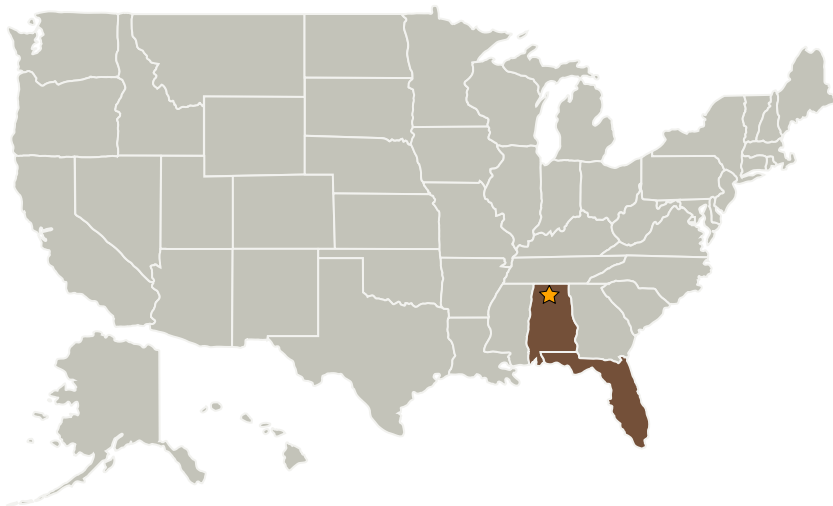
Completed Technology Project (2004 - 2006)



Project Introduction

Loci-STREAM is a CFD-based, multidisciplinary, high-fidelity design and analysis tool resulting from Phase I work whose objectives were: (a) to demonstrate the feasibility of implementing a reacting-flow pressure-based algorithm in the Loci framework, and (b) to test the robustness of a real-fluid methodology in the pressure-based framework. Loci is a rule-based programming framework which automatically handles parallel computing and provides for easy integration of multidisciplinary physics. Key current capabilities of Loci-STREAM are: (i) all-speed formulation, (ii) generalized grids, (iii) distributed memory parallel computing capability, (iv) finite rate chemistry, and (v) steady and unsteady turbulent flow capability. Phase II work will enhance Loci-STREAM and make it a reliable and practical simulation tool by incorporating the following into it: (1) high-resolution discretization schemes, (2) conjugate heat transfer, (3) real-fluid modeling, (4) efficient operator-splitting for stiff chemistry, (5) robust time-stepping, (6) improved turbulence models for unsteady flows, and (7) coupling with solid stress analysis. It is anticipated that the above capabilities coupled with smaller memory requirements of the pressure-based methodology embedded in Loci-STREAM will make computations of complex problems encountered in thrust chamber assemblies of rocket engines such as multi-element injector flows requiring large grids (100 million nodes or more) a reality.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Streamline Numerics, Inc.	Supporting Organization	Industry	Gainesville, Florida

Primary U.S. Work Locations

Alabama	Florida
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Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
 - └ TX09.4 Vehicle Systems
 - └ TX09.4.5 Modeling and Simulation for EDL